

**From:** [Paul Buellesbach](#)  
**To:** [Foley, Patrick](#); [Zachary Good](#); [Dan Roper](#); [Froikin, Sara](#)  
**Cc:** [Mazziotta, Nicholas](#); [Smith, Lora](#); [Regna, Jean](#); [Haas, Craig](#); [Cyr-Ohngemach, Margaret](#); [Burke, Shaun](#); [Patel, Harish](#); [Rivera, Alex](#); [Buettner, Robert](#); [Fried, Gregory](#); [Villatora, Liliana](#); [Pierce, Jennifer](#); [Mills, Flaire](#); [Spina, Providence](#); [Jason Sese](#); [Schaaf, Eric](#); [Simon, Paul](#); [Evangelista, Pat](#); [Lauren Brown](#); [LaPosta, Dore](#); [Naida Gavrelis](#); [Anderson, Kate](#); [Paul Buellesbach](#)  
**Subject:** RE: ERG Followup on Limetree Bay Refinery  
**Date:** Friday, May 14, 2021 4:21:33 AM  
**Attachments:** [image001.png](#)  
[TD7 Limetree Bay Air Dispersion Modeling Methodology 2021-05-14.docx](#)  
[ERG Limetree HealthWelfare \(05.14.2021\).docx](#)

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All:

Attached are two files:

1. A revised modeling analysis of the April event to reflect the ATSDR odor threshold for H2S
2. A memo summarizing impacts of all four events on health and welfare, focusing on the first and fourth events but also including the other two events

Please let us know if you have any questions or comments. Note that I will be out of pocket

**Personal Privacy (b)(6)**

this morning, but should be back on line around 10:30.

Paul

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**From:** Foley, Patrick <Foley.Patrick@epa.gov>  
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**Subject:** RE: ERG Followup on Limetree Bay Refinery

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**CAUTION:** Don't open links or attachments unless you recognize the sender and know they are safe.

Hi Paul,

I wanted to point out we are using different range of odor threshold for H<sub>2</sub>S in the 303 order:

“People can usually smell H<sub>2</sub>S at low concentrations in air when H<sub>2</sub>S concentrations are in the range of from 0.0005 to 0.3 ppm.”

This comes from <https://www.atsdr.cdc.gov/toxfaqs/tfacts114.pdf>. Your analysis used an odor threshold of “0.008 – 0.13 ppm”. Your lower bound is 16x higher than the lower bound we used. If you used the same range we used, it would change your conclusion as your modeled H<sub>2</sub>S levels were just above your odor threshold.

Pat

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**From:** Paul Buellesbach <[Paul.Buellesbach@erg.com](mailto:Paul.Buellesbach@erg.com)>

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**To:** Zachary Good <[Zachary.Good@erg.com](mailto:Zachary.Good@erg.com)>; Dan Roper <[dan.roper@erg.com](mailto:dan.roper@erg.com)>; Froikin, Sara <[Froikin.Sara@epa.gov](mailto:Froikin.Sara@epa.gov)>

**Cc:** Mazziotta, Nicholas <[mazziotta.nicholas@epa.gov](mailto:mazziotta.nicholas@epa.gov)>; Smith, Lora <[Smith.Lora@epa.gov](mailto:Smith.Lora@epa.gov)>; Regna, Jean <[Regna.Jean@epa.gov](mailto:Regna.Jean@epa.gov)>; Haas, Craig <[Haas.Craig@epa.gov](mailto:Haas.Craig@epa.gov)>; Cyr-Ohngemach, Margaret <[CyrOhngemach.Margaret@epa.gov](mailto:CyrOhngemach.Margaret@epa.gov)>; Burke, Shaun <[Burke.Shaun@epa.gov](mailto:Burke.Shaun@epa.gov)>; Patel, Harish <[Patel.Harish@epa.gov](mailto:Patel.Harish@epa.gov)>; Rivera, Alex <[Rivera.Alex@epa.gov](mailto:Rivera.Alex@epa.gov)>; Foley, Patrick <[Foley.Patrick@epa.gov](mailto:Foley.Patrick@epa.gov)>; Buettner, Robert <[Buettner.Robert@epa.gov](mailto:Buettner.Robert@epa.gov)>; Fried, Gregory <[Fried.Gregory@epa.gov](mailto:Fried.Gregory@epa.gov)>; Villatora, Liliana <[Villatora.Liliana@epa.gov](mailto:Villatora.Liliana@epa.gov)>; Pierce, Jennifer <[pierce.jennifer@epa.gov](mailto:pierce.jennifer@epa.gov)>; Mills, Flaire <[Mills.Flaire@epa.gov](mailto:Mills.Flaire@epa.gov)>; Spina, Providence <[Spina.Providence@epa.gov](mailto:Spina.Providence@epa.gov)>; Jason Sese <[Jason.Sese@erg.com](mailto:Jason.Sese@erg.com)>; Schaaf, Eric <[Schaaf.Eric@epa.gov](mailto:Schaaf.Eric@epa.gov)>; Simon, Paul <[Simon.Paul@epa.gov](mailto:Simon.Paul@epa.gov)>; Evangelista, Pat <[Evangelista.Pat@epa.gov](mailto:Evangelista.Pat@epa.gov)>; Lauren Brown <[Lauren.Brown@erg.com](mailto:Lauren.Brown@erg.com)>; LaPosta, Dore <[LaPosta.Dore@epa.gov](mailto:LaPosta.Dore@epa.gov)>; Naida Gavrelis <[Naida.Gavrelis@erg.com](mailto:Naida.Gavrelis@erg.com)>; Anderson, Kate <[Anderson.Kate@epa.gov](mailto:Anderson.Kate@epa.gov)>

**Subject:** RE: ERG Followup on Limetree Bay Refinery

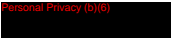
As an update, we've delivered:

- the flare safety assessment as well as a statement about how rare flare rainout is
- an assessment of the FTEs in the EHS staff
- an assessment of the April SO<sub>2</sub>/H<sub>2</sub>S event

We are still working on the general health and welfare assessment of the other events, which will also touch on the April event. We'll get that over as soon as we can. In talking with our team after the call, we determined that assessing the reportable releases would probably not be very beneficial since refineries tend to have a lot of reportable releases. We can revisit this if needed after we get through our other deliverables. Let us know if we're missing anything else.

Thanks!

Paul

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**Subject:** RE: ERG Followup on Limetree Bay Refinery

Good Evening Sara,

Please find enclosed the second installment of our comments following our call today. Our comments here focus on ERG's emission rate and air dispersion modeling evaluations associated with the April 19-24, 2021 events.

#### **ERG's Emissions and Modeling Evaluation – Summary of Conclusions**

ERG's air dispersion modeling analysis indicates that modeled 1-hour concentrations of sulfur dioxide (SO<sub>2</sub>) exceed the Acute Exposure Guideline Level-1 (AEGL-1) for SO<sub>2</sub>, which may be indicative of potential adverse impacts posed to the surrounding community due to emissions from the No. 8 Flare. The AEGL-1 value for SO<sub>2</sub> is based on a weight-of-evidence evaluation of human studies. Specifically, exposure to 0.20 parts per million (ppm) or higher may result in adverse outcomes for sensitive individuals. Above this level asthmatics are at risk of bronchoconstriction, which results in increased airway resistance. Subsequently exposed individuals in the community were faced with imminent and substantial danger to their health.

The "notable discomfort, irritation, or certain asymptomatic non-sensory effects" associated with

AEGL-1 exposure is consistent with citizen complaints received surrounding the April 19-24,

2021 excess emissions event for the No. 8 Flare. ERG also notes that this modeling analysis focused on a single source of SO<sub>2</sub> and H<sub>2</sub>S emissions at the Facility – the No. 8 Flare. Off-site concentrations of SO<sub>2</sub> are likely higher than those values presented in this analysis at each modeled receptor location, as combined impacts from all emissions sources at the Limetree Bay Terminals and Refining facility consist of the No. 8 Flare plus the other Facility emissions sources active at the time of the April 19-24, 2021 release event.

A full account of our evaluation is provided in the attached memo. Please let us know if you have any questions.

Kind regards,  
Zach Good  
*he, him, his*  
**Chemical Engineer**

Working Remotely – Mobile: Personal Privacy (b)(6)



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**From:** Dan Roper <[Dan.Roper@erg.com](mailto:Dan.Roper@erg.com)>  
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**Subject:** ERG Followup on Limetree Bay Refinery

Sara,

Here is the first installment of our comments per this morning's call.

### **Flare 8 Performance and Condition**

Both the February 4, 2021, and May 12, 2021, flaring events resulted in emission of oil droplets, or

“rainout,” that settled on the surrounding community. It is possible for such droplets to be ignited by the flare and fall as “burning rain,” but we are not aware of that happening in either of these two events. Flare systems are designed to prevent liquid carryover to the flare and subsequent rainout. In particular, API Standard 521 Pressure-relieving and Depressuring Systems addresses flare design considerations including for “knockout drums” to reduce liquid volume and droplet size to the flare burner.

- Section 5.7.9.4 states “The function of the knockout drum is to provide residence time for liquid discharges and to limit the size of droplets directed to the liquid seal drum (if present) or the flare burner. Large liquid droplets and liquid loading can cause smoke, liquid droplets (burning or not burning) to be released from the flare, or mechanical damage.”
- Section 5.7.9.6 also addresses the “risk of overfilling the flare knockout drum shall be assessed” including “the discharge of liquid from the flare (i.e. potential for flame-out, excessive smoke and unburned hydrocarbon emissions, discharge of ‘burning rain,’ pool fires around the flare stack, etc.).”

The rainout during these two flaring events may indicate the Flare 8 knockout drum(s) were not designed with sufficient capacity to prevent liquid carryover to the flare.

A photograph of Flare 8 during the May 12, 2021 flaring event shows flames and smoke emitted below the flare tip. The lower smoke plume separating from the main flare plume in particular suggests vent gas hydrocarbons were emitted bypassing the flare combustion zone. These hydrocarbons may have contributed to the oil droplets that rained out on the surrounding community. The flames and smoke below the flare tip indicate mechanical damage to the flare tip, flare riser, and/or associated components. Due to the potential for release of uncombusted hydrocarbons and hydrogen sulfide, oil droplet rainout, and/or “burning rain”, the refining process units that rely on Flare 8 as a safeguard for process safety and environmental protection may not be able to operate safely until Flare 8 is repaired and its capacity and fitness-for-service evaluated. Based on our discussions with EPA, it is our understanding that Flare 8 is the only flare currently in service.

We have supported EPA in the evaluation of hydrocarbon and acid gas flaring events as well as flare system design for environmental protection and process safety for the last 17 years. While we have reviewed flare rainout and burning rain as design considerations, we do not recall a previous reported instance from a refinery in the last 17 years, let alone two events in a few months.

Documents cited:

- API Standard 521, Sixth Edition, January 2014, accessed through API IBR Reading Room (<https://publications.api.org/>)
- <2021-05-12 - MicrosoftTeams-image 4 - flare 8.png> provided by EPA
- Note, rainout is defined as “Two-phase relief (vapor and entrained liquid) from a vent or relief device with the vapor phase dispersing to the atmosphere and the remaining liquid falling to grade or ground.” API Guide to Reporting Process Safety Events, Version 3.1 (<https://www.api.org/~media/Files/Oil-and-Natural->

[Gas/Refining/Process%20Safety/API\\_Guide\\_to\\_Report\\_PSEs.pdf](#))

## **HSE Staffing**

Per EPA's site visit, Limetree Bay Refinery has a health, safety, and environmental (HSE) staff of 5 people. Based on our experience participating in over 40 CAA inspections at refineries, we would expect a facility of the size and complexity of Limetree Bay Refinery to have an environmental staff including multiple specialists for each of the primary media: air, water, and solid/hazardous waste. In addition, a separate safety staff may include specialists in personal safety and emergency response and may include process safety as well. Therefore, we would expect an HSE staff of at least 10 to 20 people at a comparable facility.

Please let us know if you have any questions.

Thank you,

Dan Roper

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